Types SAM-01 to SAM-52
Electric Actuators

Type SAM-20 Electric Actuator, 30 mm rated travel, 6 kN actuator force

Mounting and Operating Instructions

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Definitions of the signal words used in these instructions

CAUTION!
Alerts against unsafe practices that can result in property damage only.

Note! *Indicates supplementary explanations, information and tips.*

WARNING!
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
Live parts are freely accessible!

1 General safety instructions

Observe the following instructions on installation, start-up and operation of the actuators for your own safety:

- The actuator is to be assembled, started up or operated only by trained and experienced personnel familiar with the product. According to these mounting and operating instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- Any hazards that could be caused in the connected valve by the process medium, the operating pressure or by moving parts are to be prevented by means of the appropriate measures.
- The actuator is designed for use in low-voltage systems. Observe the relevant safety regulations for wiring and maintenance. Only use protective equipment that can be protected against unintentional reconnection of the power supply.
- Disconnect the actuator from the voltage supply before wiring it.
- To prevent property damage, proper transport and storage are assumed.

CAUTION!

Only move the actuator after it has been installed. Otherwise, the torque-dependent switches will not work. As a result, the actuator will be destroyed after moving beyond the end stops.

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2 Design and principle of operation

The Type SAM-... Electric Actuators contain reversible AC or three-phase motors. The rotary motion of the motor is transmitted to the actuator stem via a gear and the corresponding transmission elements and thus converted into a linear open/close movement. The actuator can be operated by hand in case the supply voltage fails. The actuators are also fitted with an internal anti-rotation fixture.

Special features:

– Actuator forces from 2 to 25 kN
– Rated travels of 15, 30, 60 or 120 mm
– Stroking speeds from 13.5 to 50 mm/min
– Internal anti-rotation fixture
– Supply voltage 24 V, 50/60 Hz or 230 V, 50/60 Hz (other voltages on request)
– Degree of protection IP 65

2.1 Application

The actuators can be used on valves with rated travels from 15 to 120 mm. The actuator forces range from 2 to 25 kN.

The actuators' shut-off force is fixed; the travel, however, can be changed.

2.2 Versions

The electrical components are located separately from the gear underneath the sealed cover where they are protected against dust and can easily be accessed when the cover has been removed.

The basic version comprises:

– Two torque-dependent switches **DE-S1** and **DE-S2**. They switch off the motor when the force adjusted in the actuator is counterbalanced by a corresponding force. They thus protect the valve from damage and the actuator from being overloaded.

CAUTION!
When an external reversing contactor unit is used, the limit switches are not wired (upon delivery). The switches must be wired on connecting the external reversing contactor unit. The actuator will be destroyed on reaching the end stops when the motor cannot be switched off by the limit switches.

– One travel-dependent switch **WE-S3** to limit the travel in opening direction.
– Two travel-dependent switches **WE-S4** and **WE-S5** to indicate intermediate and end positions of the actuator stem.

The following optional components can be installed:

– A fourth travel-dependent switch **WE-S6** to indicate certain valve stem positions.
– One or two potentiometers or one electronic position transmitter **ESR** for remote analog transmission of the valve stem position.
– One heating resistor to prevent condensate from forming underneath the cover, e.g. when the humidity is high, when the ambient temperatures fluctuate considerably or when the actuator is installed outside.
The heating resistor deactivates the heating using a temperature relay when the temperature inside the actuator exceeds 60 °C and reactivates the heating when the temperature falls below 40 °C.
– One electronic positioner **PEL 100** for analog control 0(2) to 10 V or 0(4) to 20 mA.

2.3 Function

The rotary motion of the motor is transmitted to the nut-threaded gear via a spur gear.

The actuator stem, which is protected against being rotated, has a male thread and engages the nut thread.
The actuator stem performs a linear motion when the nut-threaded gear is turned by the gear of the motor.

2.3.1 Electrical equipment

The electrical equipment is located underneath the removable cover.

In addition to the torque-dependent switches **DE-S1** and **DE-S2** and the three travel-dependent switches **WE-S3**, **WE-S4** and **WE-S5**, the actuators can be equipped with the following switches and indicators:

– One travel-dependent switch **WE-S6**
– Two potentiometers **POT R1** and **POT R2**
– One electronic position transmitter **ESR**
– One positioner **PEL 100**

The axial motion of the actuator stem is transferred via the adjusting lever and slider to the driving lever. The driving lever produces a proportional rotary motion using a gear wheel as a measure for the two potentiometers **POT R1** and **POT R2** or the position transmitter **ESR**. The cam disks located on the gear wheel operate the switches **WE-S3**, **WE-S4**, **WE-S5** and **WE-S6**.

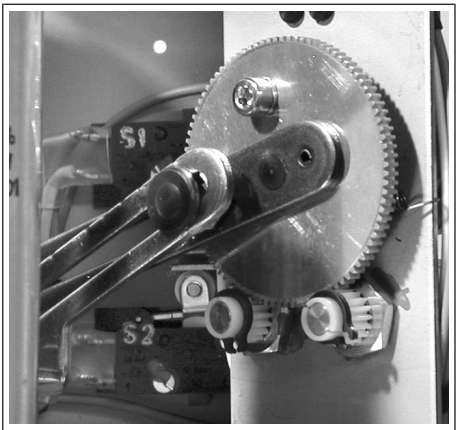


Fig. 1 · Function of switches and potentiometers, travel transmission

– Switches **DE-S1**, **DE-S2** and **WE-S3**

DE-S1 switches off the motor depending on the torque when the actuator stem extends (valve CLOSED).

DE-S2 switches off the motor depending on the torque when the actuator stem retracts (valve OPEN), provided that the valve can be subjected to load in OPEN position.

Note!
The **switching points** of switches DE-S1 and DE-S2 are preset by SAMSON and cannot be changed.

WE-S3 switches off the motor depending on the travel when the actuator stem retracts (valve OPEN), provided the actuator stem has completed the travel specified in the order.

– Switches **WE-S4**, **WE-S5** and **WE-S6**

The travel-dependent switches WE-S4, WE-S5 and optionally WE-S6 are not preset. They can be adjusted or retrofit as limit switches or signal switches as required (refer to section 8).

– Potentiometers **POT R1** and **POT R2**, position transmitter **ESR**

  The actuator can be equipped with two potentiometers **POT R1** and **POT R2**

  or

  In Types SAM-20 to -52 only, a position transmitter **ESR** with an output signal of 4(0) to 20 mA.

  Both versions enable remote analog transmission of the valve stem position.

  The potentiometers and the electronic position transmitter are preset to the required travel, but they can be changed if required (refer to section 8).

– Positioner **PEL 100**

  The actuator can already be equipped with a positioner at SAMSON (see section 10).

  Input signals:
  0(4) to 20 mA or
  0 to 10 V

  When the actual value deviates from the set point, a signal (manipulated variable) is generated to control the actuator.

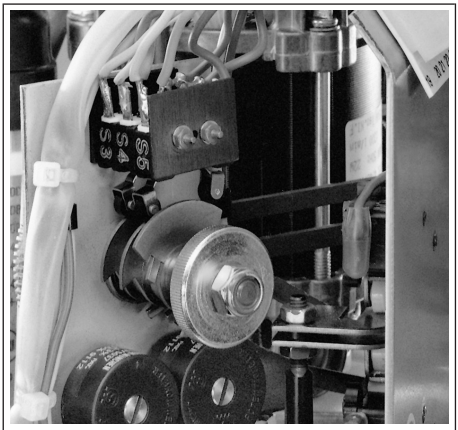


Fig. 2 · Switches and potentiometers

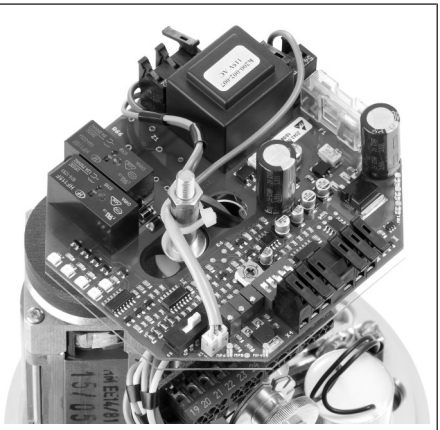


Fig. 3 · Positioner

Table 1 · Mechanical data

Type SAM...	-01	-10	-11	-12	-13	-20	-21	-22	-23	-30	-31	-32	-33	-40	-41	-42	-50	-51	-52
Actuator force kN	2	2	3.5	4.5	6	6	8	12	15	6	8	12	15	15	20	25	15	20	25
Rated travel mm	15 · 30									15 · 30 · 60							60 100 120	60 · 120	
Positioning speed mm/min	15	17 · 25 · 50			17 34	13.5 · 25 · 50			13.5 22 40	13.5 · 25 · 50			13.5 22 40	15 · 25 50		25 50	15 · 25 50		25 50
Transit time at rated travel s	120	106 · 72 · 36			106 53	133 · 72 · 36			133 82 45	266 · 144 · 72			144 · 72				288 · 144		
Adjusted travel mm	15									30							60		
Transit time s	60	53 · 36 · 18			53 26	67 · 36 · 18			67 40 22.5	133 · 72 · 36			72 · 36				144 · 92		
Mounting position	Any desired mounting position, however, not with the motor pointing down																		
Actuator stem	No mechanical travel stops, protected against being rotated by tongue and groove																		
Handwheel	Side-mounted handwheel																		
Connecting thread	M30 x 1.5									M60 x 1.5							M100 x 1.5		
Degree of protection	IP 65 according to DIN EN 60529																		
Class of protection	I according to DIN EN 61140																		
Perm. ambient temperature	–20 to +60 °C																		

Table 2 · Electrical data

Electrical connection		Inside terminal strip or terminal strip in terminal box, attached to actuator or as compact connector																	
Supply voltage		24 V, 50/60 Hz · 230 V, 50/60 Hz · 400 V, 50/60 Hz																	
Operating mode acc. to DIN VDE 0530, part 1, section 4		Intermittent duty S4-30 % ED-600 c/h																	
Power consumption																			
Type SAM...		**-01**	**-10**	**-11**	**-12**	**-13**	**-20 -30**	**-21 -31**	**-22 -32**	**-23 -33**	**-23 -33**	**-20 -30**	**-21 -31**	**-22 -32**	**-23 -33**	**-40 -50**	**-41 -51**	**-42 -52**	
Nominal current [A]	Motor 230 V/ 50 Hz	0.029	0.16		0.18	0.16 0.18	0.1 · 0.225		0.145		0.225	0.7				0.66 · 0.93			
	Motor 400 V/ 50 Hz	0.015	0.11		0.08	0.11 0.08	0.062 0.11		0.85		0.11	0.29				0.4 · 0.7			
Positioning speed mm/min		15	17 · 25		50	17 34	13.5 · 25		13.5		22	50			40	25 · 50			
Motor type (depending on positioning speed)																			
Synchronous motor		x	–	–	–	–	x	x	x	x	x	x	x	x	x	x	x	–	
Asynchronous motor with brake		–	x	x	x	x	–	–	–	–	–	–	–	–	–	–	–	–	
Asynchronous motor (brake optional, req. with positioner)		–	–	–	–	–	x	x	x	x	x	x	x	x	x	x	x	x	
Temperature monitoring		Not required, on request only										Bimetallic switch							

Table 3 · Electrical equipment

Switches and indicators		
Torque-dependent switches DE-...		
Switch DE-S... [3]	Two switches S1 and S2, max. 250 V AC	
Travel-dependent switches WE-...		
Switch WE-S... [3]	One switch S3 in opening or closing direction Two switches S4 and S5 to indicate intermediate or end positions Switch S6 as signal switch (optional)[1]	
Load	cos φ = 1: max. 5 A · cos φ = 0.8: max. 3 A · Light bulbs: max. 2 A	
Potentiometer POT ...		
Potentiometer POT ...	One or two potentiometers R1 and R2: 100 Ω, 200 Ω, 1 kΩ	
Load	Max. 1.5 W · Slider current max. 30 mA	
Electronic position transmitter ESR[2]		
Connection	Four-wire/three-wire connection	Two-wire connection
Supply voltage U_H	18 to 30 V DC	18 to 30 V DC
Max. load R_L	50 · (U_H–2.5) Ω	50 · (U_H–12) Ω
Output signal	0 to 20 or 4 to 20 mA	4 to 20 mA
Power consumption	Max. 30 mA	
Electronic positioner		
Input and output signals	0(4) to 20 mA or 0 to 10 V	
Heating		
Heating resistor	With thermostatic switch 24/110/230 V (DC/AC), 15 W	

1) Type SAM-20 to -50 only: if S6 is connected using a connector, only one potentiometer (R1) can be installed
2) Type SAM-20 to -52 only, optionally with potentiometer POT R1/R2 or electronic position transmitter ESR
3) Not wired upon delivery when actuators have an external reversing contactor unit

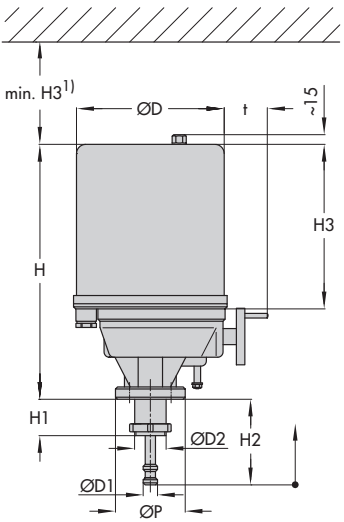
4 Dimensions

Table 4 · Dimensions in mm and weights in kg

Type SAM...		-01 to -13	-20 to -23	-30 to -33	-40 to -42	-50 to -52
Rated travel	mm	30	30	60	60	120
H		267 (283)[1]	330 (354)[1]		413 (452)[1]	448 (487)[1]
H1		34		54		92
H2 max.		90		165		315
H3		158 (174)[1]	174 (197)[1]		191 (232)[1]	
ØD		145	188		216	
ØD1		16		22	40	
ØD2	Thread	M30 x 1.5		M60 x 1.5		M100 x 2
ØP		74	130	140		158
t		~40	~70			
Approx. weight	kg	5	6	7	15	19

[1] Values in parentheses apply to actuator with positioner

Dimensional drawing



[1] Minimum clearance to ensure that the cover can still be removed when the actuator is installed

Fig. 4 · Dimensions of Types SAM-01 to -52 Actuators

5 Installation

5.1 Installation requirements

Make sure the following requirements are met before starting installation:

- The proper voltages and input signals required to operate the actuator are available.
- The electrical lines are de-energized.
- The pipelines are depressurized and cold.

Choose the mounting position so that the following requirements are met:

- The actuator can be accessed easily.
- There is sufficient space to remove the cover (refer to section 4).
- The actuator is protected against excessive heat radiation.
- The ambient temperature is between –20 and +60 °C.

If the actuator is installed outdoors, it must be protected by an additional cover, e.g. against humidity (rain, snow), heat (direct sunlight), frost, strong draft, dust etc.

If the actuator is exposed to high humidity and ambient temperatures that fluctuate considerably, we recommend to install a heating resistor to minimize condensate formation in the housing (refer to section 9.1).

If the actuator is installed in ambient conditions with high concentrations of pollutants (e.g. areas with a high traffic volume, industrial areas, coastal regions), the external actuator parts must be made of stainless steel and be coated with a special paint.

5.2 Mounting position

The actuator can be installed in any desired position except with the motor pointing down.

When the actuator is installed with the actuator stem in horizontal position, mount the yoke such that its two rods are positioned on top of each other in the vertical plane.

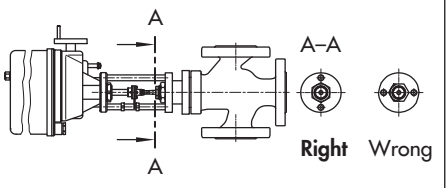


Fig. 5 · Mounting position with horizontal actuator stem

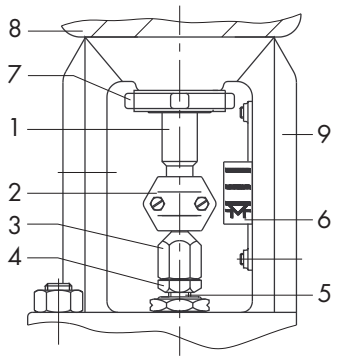
5.3 Assembling valve and actuator

Upon delivery, the actuator stem is extended to the lower end position.

Check the following before assembly:

- Do the technical data of the actuator match the operating conditions?
- Is the valve complete (yoke on the actuator or the valve)?
- Do the coupling parts match?
- Is the actuator ready for attachment to the valve (with ring nut and coupling parts)?
- Are additional accessories already installed in the actuator (if applicable)?
- Does the supply voltage to be applied match the voltage of the actuator?

– Do the specifications on the nameplate match the motor specifications?
– Does the actuator travel (to be) adjusted match the valve travel?



1 Actuator stem
2 Coupling
3 Coupling nut
4 Lock nut
5 Plug stem
6 Travel indicator scale
7 Ring nut
8 Actuator
9 Yoke

Fig. 6 · Assembly (detail)

How to proceed:

CAUTION!
To avoid damaging the internal anti-rotation fixture, make absolutely sure that the actuator stem is not extended or retracted more than specified in the max. and min. specifications. Refer to section 14.

– Push the plug stem (5) all the way into the valve.
– Move the actuator stem (1) to mid-position (refer to section 5.4).
– Place the actuator (8) on the valve bonnet, letting the ring nut (7) slide onto the valve stem. Tighten the ring nut.
– Push up the plug stem (5). Connect the coupling nut (3) and actuator stem (1) using the halves of the coupling (2) and tighten with the screws.
– Turn the handwheel clockwise to move the actuator stem (1) to its end position.
– Align the travel indicator scale (6) with the tip of the coupling (2) and tighten it.
– Use the lock nut (4) to lock the plug stem (5) against the coupling nut (3).

CAUTION!
Do not press the valve plug onto the seat and turn as this may damage the valve's seat-plug trim and the actuator.

Proceed in a similar way when attaching the actuator to other valve types (e.g. butterfly valves with mounting block).

5.4 Manual operation

The actuator stem can be extracted or retracted manually in case the supply voltage fails or when installing or adjusting the actuator.

CAUTION!

Do not operate the handwheel while the motor is in motion.

Do not override the adjusted travel range during manual operation (observe actual dimensions) as this could damage the actuator. This applies especially to uninstalled actuators.

– Unlock the motor and actuator stem using the disengaging stem to move the actuator stem with the side-mounted handwheel.
– If the actuator is installed vertically, push down the disengaging stem in the direction of the extending actuator stem.
  At the same time, turn the handwheel clockwise and counterclockwise alternately until it engages noticeably: turn the handwheel clockwise to extend the actuator stem and counterclockwise to retract it.
– The actuator will return to motor operation automatically as soon as the disengaging stem is released.

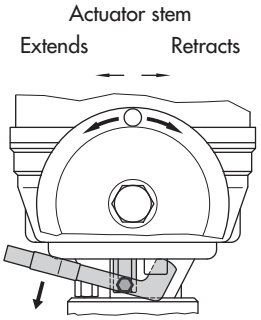


Fig. 7 · Manual operation

6 Electrical connection

WARNING!

Connection and start-up of the actuator require expert knowledge in installing low-voltage systems (according to DIN VDE 0100), in accident prevention and in the special start-up conditions for the actuators.

This type of work is to be performed by qualified personnel only (refer to the safety instructions in section 1).

- *Make sure the electrical lines are de-energized when connecting the actuator. Only use protective equipment that can be protected against unintentional reconnection of the power supply.*
- *When installing and connecting electrical lines, observe the applicable DIN VDE regulations as well as the regulations of your local power supplier.*
- *Check that the power supply voltage and power frequency match the specifications on the actuator's nameplate.*
- *Select the cross-section of the line to match the actuator's power consumption and the required line length.*
  Observe a minimum cross-section of 1.5 mm² (or as specified in the local regulations). Insufficient line cross-sections are often the cause of alleged malfunctions.
- *Make sure the system is equipped with a fuse of max. 6 A.*
- *Make sure controllers or switchgear connected ahead of the actuator are sized sufficiently. If required, install a coupling relay between them.*
- *To disconnect the power supply to the actuator and de-energize the actuator for calibration and maintenance, install a suitable line breaker in the system, which guarantees that all poles (except the grounding conductor) are disconnected. When switched off, this line breaker must be protected against unintentional reconnection of the power supply.*
- *Use a suitable power supply system, which guarantees that no hazardous voltages reach the actuator in normal operation or in case of a fault.*

Failure to observe these safety instructions can result in death, serious injury or considerable property damage.

6.1 Removing the cover

WARNING!
De-energize the supply lines and protect them against unintentional reconnection of the power supply before removing the cover and when performing calibration or maintenance work.

– Unscrew the cap nut.
– Remove the gasket.
– Slightly turn the cover while pulling it off.

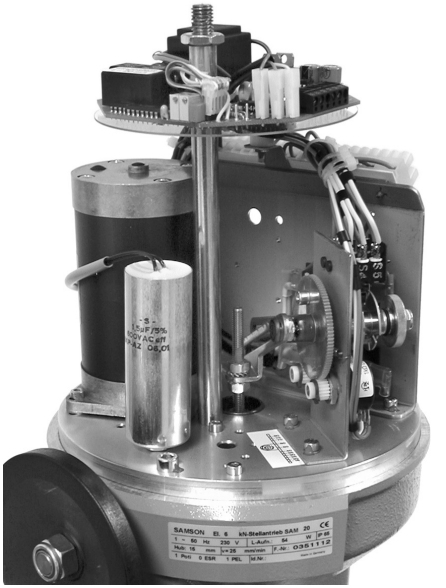


Fig. 8 · Type SAM-20 Actuator, cover removed

WARNING!
When the cover is removed, the actuator may only be operated briefly, e.g. for test runs or when performing complex calibrations on electrical components, such as potentiometers, limit switches or positioning electronics.
While the cover is removed, there is unobstructed access to hazardous, live, uninsulated, moving and rotating parts. Calibrating the actuator improperly or without applying the necessary caution can result in death, serious injury or considerable property damage.
Such work is to be performed by qualified personnel only (refer to the safety instructions in section 1).
Any other operation of the actuator with the cover removed is prohibited!

6.2 Connecting the actuator

WARNING!
Observe the circuit diagram inside the cover for electrical connection! When installing and connecting electrical lines, observe the applicable DIN VDE regulations as well as the regulations of your local power supplier.
Particularly with 24 V actuators, make sure that line cross-sections are sized sufficiently and that the transformer is dimensioned with a sufficient reserve.

– Route and secure the lines in the actuator such that they are protected against moving or rotating parts and cannot be damaged when removing or replacing the cover.

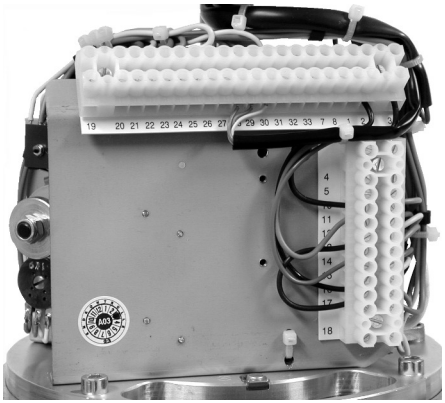


Fig. 9 · Terminal strips for electrical connection

6.3 Start-up

The following applies to the first test run:

– Use the handwheel to move the actuator stem to a mid-travel position.
– Connect the protective earth to the associated ground terminal. ⏚
– Apply the supply voltage.

CAUTION!
Do not move the actuator beyond its given travel range, neither electrically nor manually. The actuator can be damaged if the given travel limits are exceeded.

AC actuators (230 V/50 Hz)
N = terminal **1** **L** = terminal **3**
Actuator stem extends from the actuator and moves to **CLOSED** position (closing).
N = terminal **1** **L** = terminal **2**
Actuator stem retracts into the actuator and moves to **OPEN** position (opening).

Three-phase current actuators (400 V/50 Hz)
Connect external reversing contactors ahead of the actuator.
L_1 = terminal **1**, L_2 = terminal **2**, L_3 = terminal **3**

CAUTION!
With the wrong direction of rotation, even properly wired torque switches cannot switch off the motor. Only apply commands briefly when testing the operating direction.

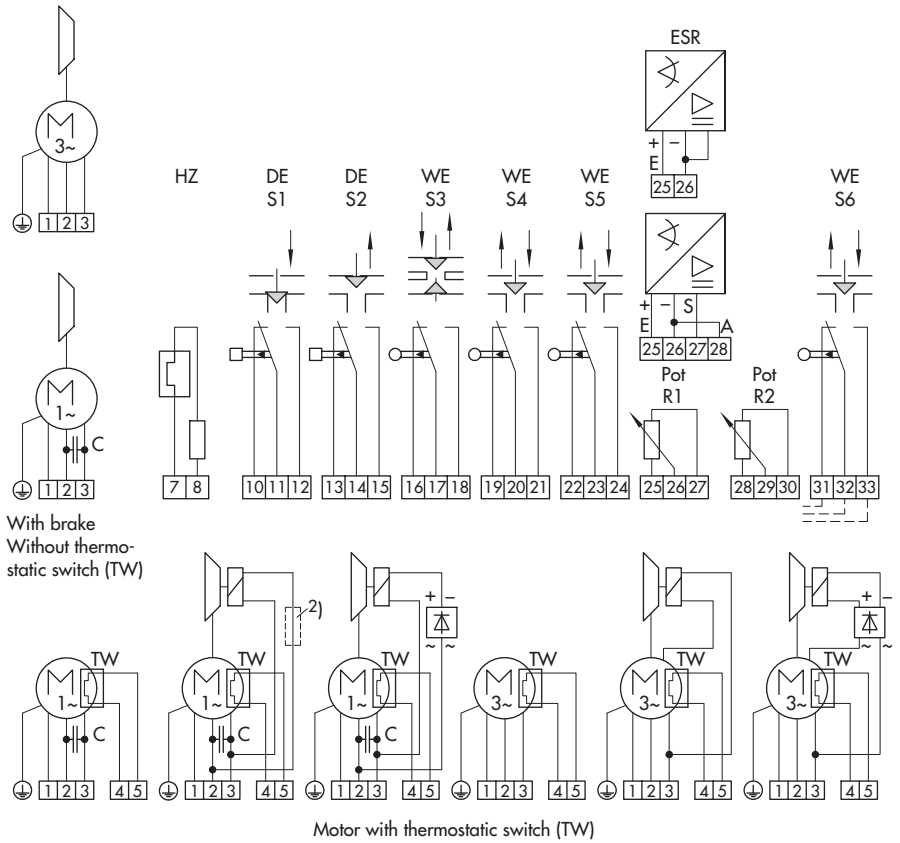
Apply the supply voltage, thus briefly giving the command to open or close.

– Check whether the actuator stem moves in the right direction. If this is not the case, switch motor connections 2 and 3 and repeat the test.

Circuit diagram of Types SAM-01 to -52 Actuators

Switches and potentiometers
If a fourth WE-S6 is connected using a connector, only one potentiometer POT R1 can be installed

Adjust the travel-dependent switch WE-S3 to limit the valve travel in opening direction by switching off the motor (refer to section 8.4).
Do not exceed the travel adjusted at the actuator.



HZ	Heating resistor	WE-S	Travel-dependent limit switch
DE-S	Torque-dependent limit switch	ESR	Electronic position transmitter

Fig. 10 · Circuit diagram of Types SAM-01 to -52 Actuators

7 Connection examples

Connection example 1 (three-way valve)

– Operated using single-phase alternating current (three-step control)
– Switched off by switch DE-S1 (limitation in closing direction, CLOSED) and DE-S2 (limitation in opening direction, OPEN) depending on load

Note!

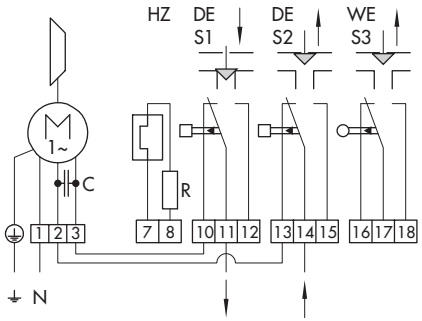
If the actuator is to be used with only two torque-dependent switches DE-S1 and DE-S2, the associated valve must be designed to support the forces of the actuator. Observe the documentation for the valve. Contact the valve manufacturer, if required.

Connecting the actuator

– Connect the protective earth of the connecting line (green/yellow wire) to the associated ground terminal.
– Connect N of the connecting line to terminal 1.
– Connect the control line for actuator stem extends (CLOSED) to terminal 11.
– Connect the control line for actuator stem retracts (OPEN) to terminal 14.
– Install the jumpers between terminals 10 and 3 as well as between terminals 13 and 2.

Testing the actuator

– Control the actuator using the three-step controller.
– Use an insulated screwdriver to operate the switching rolls of the switches and check whether the switches really deactivate the motor: operate the upper switch DE-S1 for actuator stem extends and the lower switch DE-S2 for actuator stem retracts.
– If required, switch the motor supply jumpers at terminals 2 and 3.



HZ Heating resistor
DE-S1 Torque-dependent limit switch S1, CLOSED position
DE-S2 Torque-dependent limit switch S2, OPEN position
WE-S3 Travel-dependent limit switch S3, OPEN position

Fig. 11 · Circuit diagram, connection example 1

Connection example 2 (three-way valve)

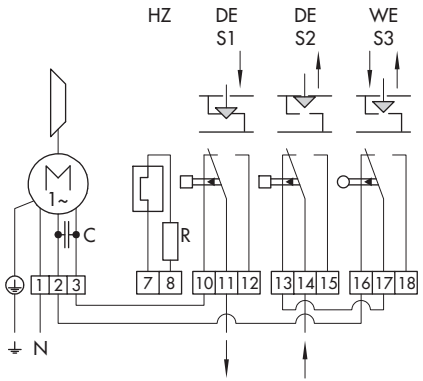
- Operated using single-phase alternating current (three-step control)
- Switched off for actuator stem extends (closing direction) depending on load by switch DE-S1
- Switched off for actuator stem retracts (opening direction) depending on load by switch DE-S2 connected in series with switch WE-S3

Connecting the actuator

- Connect the protective earth of the connecting line (green/yellow wire) to the associated ground terminal.
- Connect N of the connecting line to terminal 1.
- Connect the control line for actuator stem extends (CLOSED) to terminal 11.
- Connect the control line for actuator stem retracts (OPEN) to terminal 14.
- Install the jumpers between terminals 10 and 3, between terminals 16 and 2 as well as between terminals 13 and 17.

Testing the actuator

- Control the actuator using the three-step controller.
- Use an insulated screwdriver to operate the switching rolls of the switches and check whether the switches really deactivate the motor: operate the upper switch DE-S1 for actuator stem extends and the lower switch DE-S2 for actuator stem retracts.
- If required, switch the motor supply jumpers at terminals 2 and 3.



HZ Heating resistor
DE-S1 Torque-dependent limit switch S1, CLOSED position
DE-S2 Torque-dependent limit switch S2, OPEN position
WE-S3 Travel-dependent limit switch S3, OPEN position

Fig. 12 · Circuit diagram, connection example 2

8 Adjustment and calibration

8.1 Travel adjustment

Upon delivery, the actuator is adjusted to the travel specified in the order. If required, this default travel can be changed.

The slotted lever connected to the actuator stem has travel markings. The glued-in scale indicates adjustable travel values.

To change the default travel, extend the actuator stem to its end position so that the two adjustment levers are parallel (valve CLOSED and valve position indicator at the bottom marking).

How to proceed

- Use an open-end wrench with width across flats (SW) 10 to remove the flat nut from the slider.
- Move the slider between the two slotted levers to set the desired travel according to the travel markings.
- Secure the slider again using the flat nut.
- Move the position indicators on the yoke to the new end positions.

Note!
The travel can be adjusted continuously as specified on the nameplate, which means that the travel can be set to any desired position between the markings.
Remember to readjust the limit switch WE-S3 after the travel has been changed (refer to section 8.4).

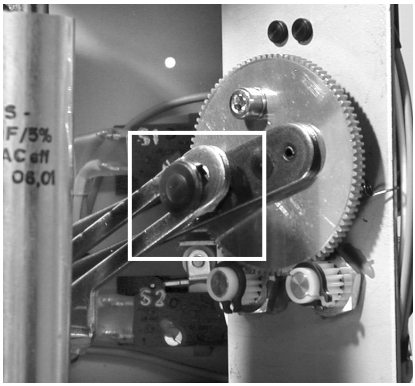


Fig. 13 · Travel adjustment

8.2 Potentiometer adjustment

Depending on the version, the actuator can be equipped with one or two potentiometers (POT R1 and POT R2; refer to Fig. 14).

Make sure the potentiometers POT R1 and POT R2 are in their respective end positions when the actuator stem is in CLOSED or OPEN position.

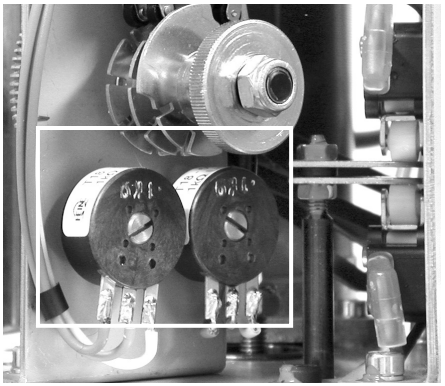


Fig. 14 · Potentiometers POT R1/R2

The potentiometers can be fine-tuned as follows:

– Use the handwheel to move the actuator to CLOSED end position (actuator stem fully extended) until DE-S1 is switched. Make sure the adjusting lever and driving lever are parallel in their tilted position.
– Use a suitable screwdriver to move the potentiometers' slider to its end position. To do so, turn the potentiometer shaft counterclockwise until the stop can be felt slightly.
– Move the actuator through the adjusted travel range to OPEN end position (actuator stem fully retracted). The potentiometers will be rotated to the other end position.
– Use an ohmmeter to monitor the potentiometer movement and check whether the potentiometer is moved through its entire range.

Note!
If the potentiometers reach their stops when moving to their end positions, the sliding clutch between potentiometer and pinion is activated and prevents the potentiometers from being damaged. This means, however, that the measurement results cannot be reproduced clearly any longer.
In this case, adjust a larger travel using the slider and adjusting lever (refer to section 8.1).

In actuators with an installed electric positioner, POT R1 is coupled internally to the positioner. As a result, its resistance value is not transmitted externally for indication.

8.3 Electronic position transmitter

Types SAM-20 to -52 Actuators can be equipped with an electronic position transmitter ESR instead of the potentiometers POT R1 and R2.

The transmitter indicates the current travel position by issuing an output current between 0(4) and 20 mA. As a result, it is particularly suitable for remote transmission of the valve position.

Operating mode

The electronic position transmitter can be operated in two different modes:

Select normal (N) or reverse (R) mode using the selector switch.

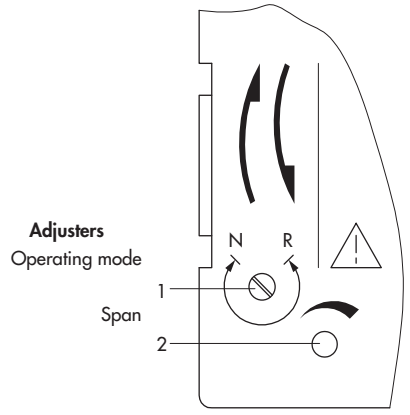


Fig. 15 · Adjusters for operating mode and span

Note!
Make sure the adjuster for the operating mode is always set to one end position (N or R); otherwise, the lower and upper range values cannot be adjusted.

Normal mode

Rotate the actuator gearwheel clockwise for an increasing characteristic and counterclockwise for a decreasing characteristic.

Reverse mode

Rotate the actuator gearwheel counterclockwise for an increasing characteristic and clockwise for a decreasing characteristic.

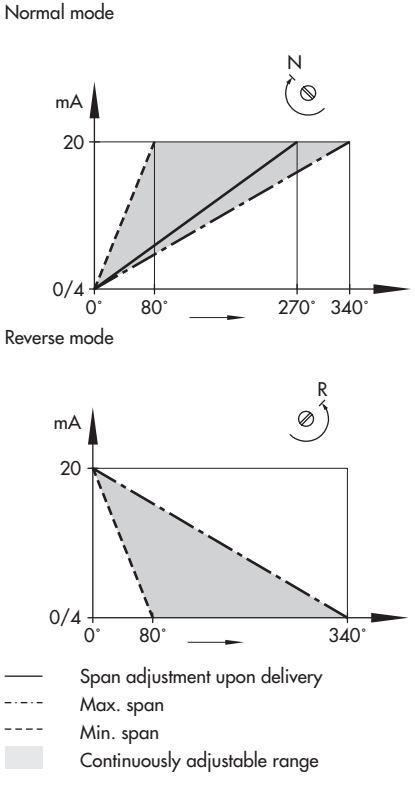


Fig. 16 · Span, adjustment range

Note!
In actuators with reverse operating mode, the position with the actuator stem fully ***extended*** *corresponds to* ***OPEN*** *position.*

Adjusting an output signal of 0 or 4 mA

– Move the actuator stem to the position at which the output signal is to be 0 or 4 mA.
– Rotate the black adjustment wheel against the white actuator gearwheel to adjust the output current to:
  – 3.98 to 4.02 mA for two-wire connection
  or
  – 0.01 to 0.02 mA for three-wire connection.

Note!
In three-wire connection, the sign is not changed during zero passage. The actuator indicates 0 mA across a range of 8°. As a result, we recommend to adjust a value that is as small as possible but not zero (e.g. +0.01 mA).

Adjusting an output signal of 20 mA

– Move the actuator stem to the position at which the output signal is to be 20 mA.
– Use the span adjuster (refer to Fig. 15) to set the output current to 20 ±0.02 mA.
– Check the output signal adjustment for 0 or 4 mA and repeat the adjustment if required.

8.4 Limit switch WE-S3

Types SAM-20 to -52 Actuators

Readjust the cam disk associated with WE-S3 so that the actuator is switched off after performing the required travel.

– Move the actuator stem to OPEN end position.
– Slightly loosen the knurled nut so that the cam disk can be moved.

Note!
When the knurled nut is loosened, the cam disks may come loose unintentionally and thus change the associated switching position.

– Adjust the cam disk for WE-S3 in opening direction so that the switch deactivates the actuator. Check with a continuity tester.
– Keep the cam disk in its current position and retighten the knurled nut by hand.
– Test-run the actuator to check the switching position.

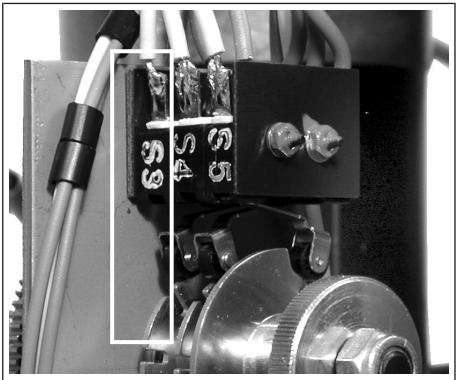


Fig. 18 · Switch WE-S3 (background) with associated cam disk

8.5 Signal switches WE-S4 to WE-S6

Types SAM-20 to -52 Actuators

The travel-dependent switches WE-S4 to WE-S6 can be adjusted freely to indicate certain travel positions.

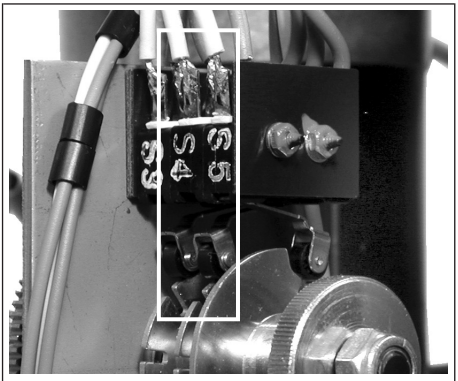


Fig. 17 · Switches WE-S4 and WE-S5; switch WE-S6 not installed

– Move the actuator stem to the required position for each switch.
– Loosen the knurled nut.
– Adjust the cam disk of each switch as described. Check with a continuity tester.
– Keep the cam disk in its current position and retighten the knurled nut by hand.
– Test-run the actuator to check the switching position.

Types SAM-01 to -11 Actuators

The travel-dependent limit switches WE-S3 and WE-S6 are mounted on the lateral mounting plate. They are operated by the cam attached to the upper end of the actuator stem.

Depending on the actuator movement in opening or closing direction, the associated limit switch deactivates the actuator depending on the travel.

The switching position can be adjusted as required by moving the associated switch axially over the oblong hole. Retighten the switch.

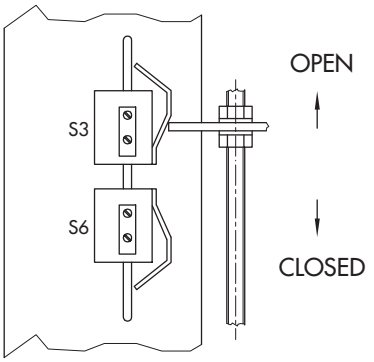


Fig. 19 · Cam of WE-S3, WE-S6

Switch WE-S3

– Use the handwheel to move the actuator stem to fully retracted position (OPEN).

Make sure switch WE-S3 is above the cam.

Switch WE-S6

– Use the handwheel to move the actuator stem to fully extended position (CLOSED).

Make sure switch WE-S6 is below the cam.

In both cases, proceed as follows:

– Slightly loosen the mounting screws at the back of the respective switch so that the switch can be moved.
– Push the switch up or down until the cam deactivates the actuator depending on the travel. Check with a continuity tester.
– Retighten the mounting screws.
– Test-run the actuator to check the switching position.

9 Additional electrical equipment

9.1 Heating

We recommend to install a heating resistor to prevent condensate from forming underneath the cover, e.g. when the humidity is high, when the ambient temperatures fluctuate considerably or when the actuator is installed outdoors.

The heating resistor R is controlled by a thermostatic switch TW (bimetallic contact). A continuous operating voltage is required for operation (specify when ordering).

The heating resistor deactivates the heating using a temperature relay when the temperature inside the actuator exceeds 60 °C and reactivates the heating when the temperature falls below 40 °C.

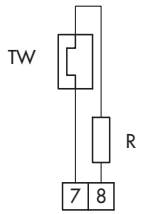


Fig. 20 · Heating resistor R and thermostatic switch TW, circuit diagram

Supply the heating resistor with thermostatic switch with voltage by connecting it to terminals 7 and 8.

9.1.1 Retrofitting a heating resistor

A heating resistor can be retrofit and connected at a later date.

– Remove the cover.
– Attach the heating resistor at the intended location (refer to Fig. 21) using the two included self-cutting screws.
– Attach the thermostatic switch to the bore hole in the mounting bracket using a nut with width across flats SW 7.
– Connect the stranded wires of the thermostatic switch and the heating resistor to terminals 7 and 8.
– Route and attach the lines in the actuator so that they are protected against moving or rotating parts and are not damaged when removing or replacing the cover.

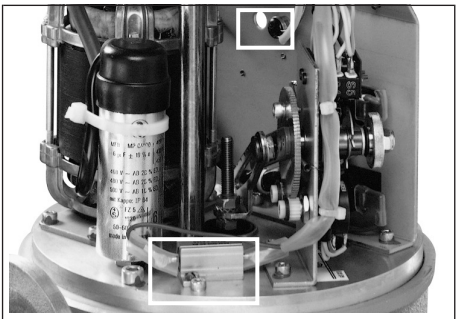


Fig. 21 · Heating resistor R (bottom), thermostatic switch TW (background, top)

10 Positioner

10.1 Function

The PEL 100 positioner is designed to control and position the actuator. By applying a continuous input signal, the positioner moves the actuator stem to the desired position. To do so, the positioner compares the actual value (controlled variable) and the set point (reference variable). If these two values deviate, the positioner issues a voltage signal (manipulated variable) to control the valve until the set point and actual value are within a tolerance band.

Table 5 · LED blinking pattern

LED	Meaning	Indication
V17	Voltage supply OK	Green LED
V18	Actuator stem retracts	Green LED
V19	Actuator stem extends	Yellow LED
V21	Dead band active	Red LED
V22	E1 < 4 mA	Red LED

To determine the position of the actuator stem, a potentiometer to record the actuator's travel movement is required in the actuator.

Use potentiometers P1, P2 and P4 as well as switches S2 and S3 to adjust settings, e.g. travel calibration, split-range operation, reversed actuator action and dead band.

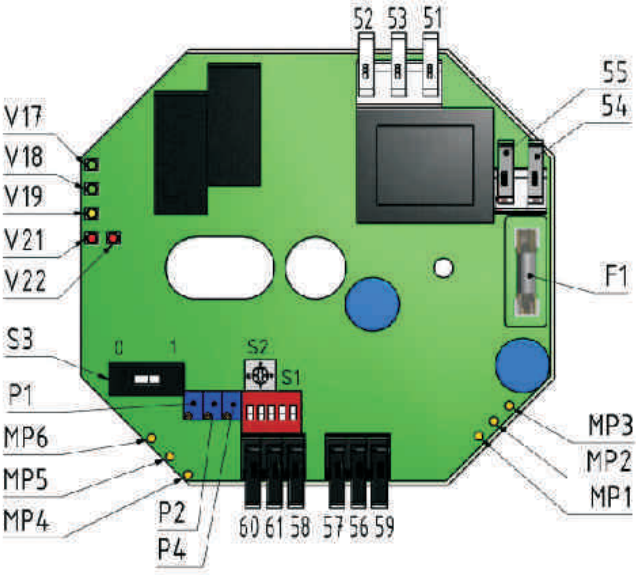


Fig. 22 · Printed circuit board of PEL 100 positioner, viewed from the top

The DIP switch settings of switch S1 allow additional functions to be adjusted (e.g. preset zero, spreading of the potentiometer signal and behavior upon signal failure).

The positioner comes with a minimum dead band of 200 ms to prevent sudden changes of the actuator action or the rapid activation and deactivation of the actuator.

By default, the positioner has a feedback signal that returns the current position of the actuator stem. The signal range corresponds to the input signal range.
The feedback signal is **not** isolated from the input.

The type of the control signal (voltage or current) is determined by the terminal assignment. Switching or changes of the soldering connections are not necessary.

10.2 Mounting the positioner

Mechanical attachment is usually done at SAMSON. It may not always be possible to retrofit a positioner. If the actuator is designed for retrofitting a positioner, use the PEL mounting kit.

Make sure the potentiometer (and, if applicable, the switches and indicators) required for positioner operation have been mounted in the actuator before retrofitting a positioner.

Mount the actuator on the valve. Adjust the signals and indicators. Adjust zero of the potentiometer as described in section 8.2.

10.3 Electrical connection

10.3.1 Terminal assignment

To avoid interference, route the signal line separately from the voltage supply line. Particularly when using voltage signals, we recommend to use a shielded cable and connect the shield to the protective earth (PE) connection on the actuator housing.

Table 6 · Terminal X4

Terminal	Function	
60	Current output	0(4) to 20 mA
61	Voltage output	0(2) to 10 V
58	Ground (GND)	Ground
57	Ground (GND)	Ground
56	Voltage input	0(2) to 10 V
59	Current input	0(4) to 20 mA

The impedance of the current input is 50 Ω, that of the voltage input is 20 kΩ.

Table 7 · Terminal X2

Terminal	Function	–
54	L supply voltage Phase	50 or 60 Hz
55	N supply voltage Neutral	

Table 8 · Terminal X3

Terminal	Function	–
51	L ⇑ connection for actuator stem retracts	50 or 60 Hz
52	N Neutral	
53	L ⇓ connection for actuator stem extends	50 or 60 Hz

Table 9 · Connector X4

The potentiometer is plugged onto the positioner's printed circuit board using a connector.

Pin	Function	Color
1	Maximum value	Blue
2	Sensing at the slider	Green
3	Zero	Red

The color assignment depends on the actuator type.

10.3.2 Determining input and output signals

The actuator is either preset to 0 to 10 V, 0 to 20 mA or to 2 to 10 V, 4 to 20 mA. Depending on the configuration, the lines for the input and output signals are connected to terminal X4.

The configuration of the positioner can be changed as described in section 10.4.6.

10.4 Start-up and settings

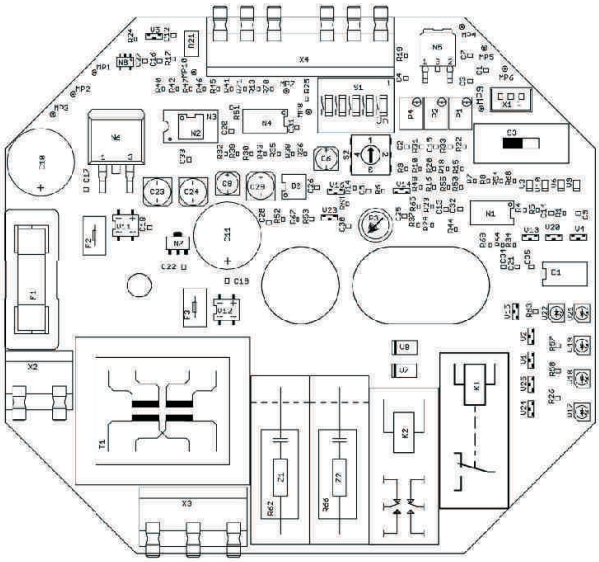


Fig. 23 · PEL 100 positioner

Table 10 · Potentiometers

Potentiometers	Function	Action
P1	Lower limit adjustment	Turn clockwise to lower the limit
P2	Upper limit adjustment	Turn clockwise to lower the limit
P3	Span adjustment	Turn counterclockwise to spread the potentiometer signal

Table 11 · Switches

Switch	Function	ON	OFF
S1.1	Preset zero	0 mA	4 mA
S1.2	Spreading	OFF	ON
S1.3	Fail-close (extends)	ON	OFF
S1.4	Fail-open (retracts)	ON	OFF
S1.5	Behavior upon failure	ON	OFF
Switch	**Description**	**Position**	**Action**
S2	Dead band	1 2 3 4	1.5 % 1.0 % 0.5 % 0.25 %
S3	Actuator action reversal	0 1	OFF ON

Table 12 · Measurement points

Point	Description	Action	Signal
Mp1	Supply voltage +15 V		+15 V
Mp2	Supply voltage –5 V		–5 V
Mp3	Ground		
Mp4	Voltage at max. value (actual value)	At 0 to 10 V or 0 to 20 mA	10.1 V
Mp5	Voltage coming from potentiometer slider		
Mp6	Voltage at min. value (actual value)	At 0 to 10 V or 0 to 20 mA At 2 to 10 V or 4 to 20 mA	0 V 2 V

10.4.1 Calibrating the positioning electronics to the travel

The positioning electronics are adjusted by SAMSON for the specified travel. As a result, only slight calibrations should be necessary.

The following requirements must be met to proceed with calibration:

– The actuator is properly mounted on the valve.
– The switches and indicators are properly adjusted to the valve travel. Make sure the potentiometer's zero point is properly aligned with the travel's lower end position.
– The limit switches are properly adjusted to the valve travel.

The positioning electronics can be adjusted so that the actuator is deactivated either by the switches (DE, WE) or the positioning electronics themselves when it reaches the end positions.

If the actuator is deactivated by the switches, adjust the potentiometers on the positioning electronics so that the LEDs just remain illuminated when the end position is reached.

At the input, set the lower set point (0 or 4 mA, 0 V) for the lower end position. Turn potentiometer P1 counterclockwise until the actuator is deactivated by the associated switch and LED V19 just remains illuminated. Turn the potentiometer back to check.

For the upper end position, use potentiometer P2 and LED V18 to preset the set point.

Turn potentiometer P2 clockwise to shift the deactivation point upward. When the actuator is to be deactivated by the switches, change the potentiometer setting until the LED just remains illuminated.

If the potentiometer's angle of rotation cannot be used completely when the travel is very small, use the spreading function to adapt the input range. Activate this function by setting switch S1.2 to OFF.

Turn potentiometer P4 counterclockwise to shift the upper deactivation point downward.

10.4.2 Adjusting the dead band

The adjusted dead band depends on the actuator. It is preset by SAMSON and should not be changed. If the dead band is set too small, the actuator oscillates around the set point, which will cause the positioner and actuator to get worn out prematurely.

If oscillations are detected, they can be reduced by increasing the dead band.

Make sure the adjusted values are retained when replacing the positioning electronics.

10.4.3 Reversing the actuator action

The actuator action can be reversed by changing the setting of switch S3.

It may be necessary to adapt the end positions or travel (refer to section 10.4.1).

10.4.4 Detecting wire breaks

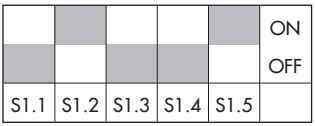
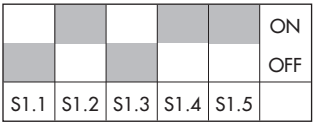
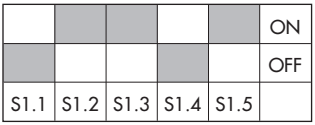
The wire break detection function allows input signal failures to be detected. Activate or deactivate the function using switch S1.5.

To use this function, the input signal must be adjusted to 4 to 20 mA or 2 to 10 V.

Note!

*Wire breaks cannot be detected when the input signal is adjusted to **0 to 10 V** and **0 to 20 mA**. Malfunctions of the positioner may occur.*

The fail-safe function is triggered as soon as the input signal falls below 3.5 mA. Use switches S1.3 and S1.4 to set the actuator behavior in case of a signal failure.

Position of the DIP switches	Fail-safe function
	**Last travel value**
	**Actuator stem retracts**
	**Actuator stem extends**

10.4.5 Split-range operation

To adjust split-range operation, apply the set point for the upper end position (e.g. 12 mA) to the actuator.
Turn potentiometer P2 until the travel corresponds to the upper end position. Turning the potentiometer counterclockwise causes the actuator stem to retract.
The lowest value adjustable for the upper deactivation point is approx. 8 mA or 4 V.

Apply the set point for the lower end position (e.g. 6 mA) to the actuator. Turn potentiometer P1 until the travel corresponds to the lower end position. Turning the potentiometer counterclockwise causes the actuator stem to extend.
The highest value adjustable for the lower deactivation point is approx. 13.2 mA or 6.6 V.

Check the adjustment by moving the valve to its upper and lower end positions again.

10.4.6 Changing the preset signal range for the set point

The positioning electronics can be preset using measurement points without requiring an input signal (refer to section 10.4.1).

Adjusting a signal from 4 to 20 mA or 2 to 10 V

Configuration of DIP switch S1

	■				ON
■		■	■	■	OFF
S1.1	S1.2	S1.3	S1.4	S1.5	

– Apply voltage to terminals *54* and *55*.
– Measure the voltage between measurement points 3 and 6.
– Use potentiometer P1 to adjust the voltage to 2.0 V.
– Measure the voltage between measurement points 3 and 4.
– Use potentiometer P2 to adjust the voltage to 10.0 V.

Adjusting a signal from 0 to 20 mA or 0 to 10 V

Configuration of DIP switch S1

■	■				ON
		■	■	■	OFF
S1.1	S1.2	S1.3	S1.4	S1.5	

– Apply voltage to terminals *54* and *55*.
– Measure the voltage between measurement points 3 and 6.
– Use potentiometer P1 to adjust the voltage to 0.0 V.
– Measure the voltage between measurement points 3 and 4.
– Use potentiometer P2 to adjust the voltage to 10.0 V.

11 Maintenance and service

11.1 Maintenance

The gearing and actuator stem need to be lubricated after approx. 200,000 full travel cycles.

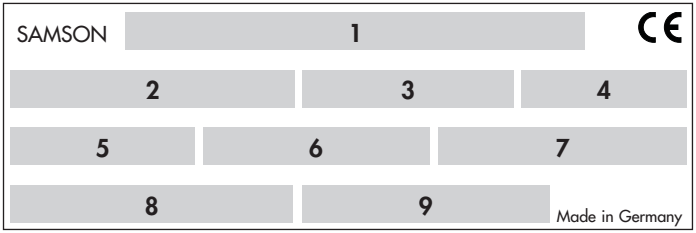
We recommend using **Klüber Microlube GL 261**.

11.2 Service

Do not repair the actuator yourself! If malfunctions or defects occur, contact the SAMSON After-sales Service for support. Alternatively, return the actuator, including the product number and a detailed failure report, to SAMSON Frankfurt for inspection.

The address of SAMSON AG, its subsidiaries, representatives and service facilities worldwide can be found on the Internet at www.samson.de, in a SAMSON product catalog or on the back of these mounting and operating instructions.

12 Nameplate



1	Actuator force, type designation	4	Degree of protection	7	Product no.
2	Supply voltage, frequency	5	Rated travel	8	Electrical equipment
3	Power consumption	6	Stroking speed	9	Configuration ID (Var.-ID)

Fig. 24 · Nameplate

13 Connection examples

The circuit diagrams are examples and intended for your information only. The circuit diagram included in the actuator cover is binding.

Connection of the torque-dependent switches DE and the travel-dependent switches WE depends on the intended use (valve type, deactivation in end position etc.) and is to be determined by the operator.

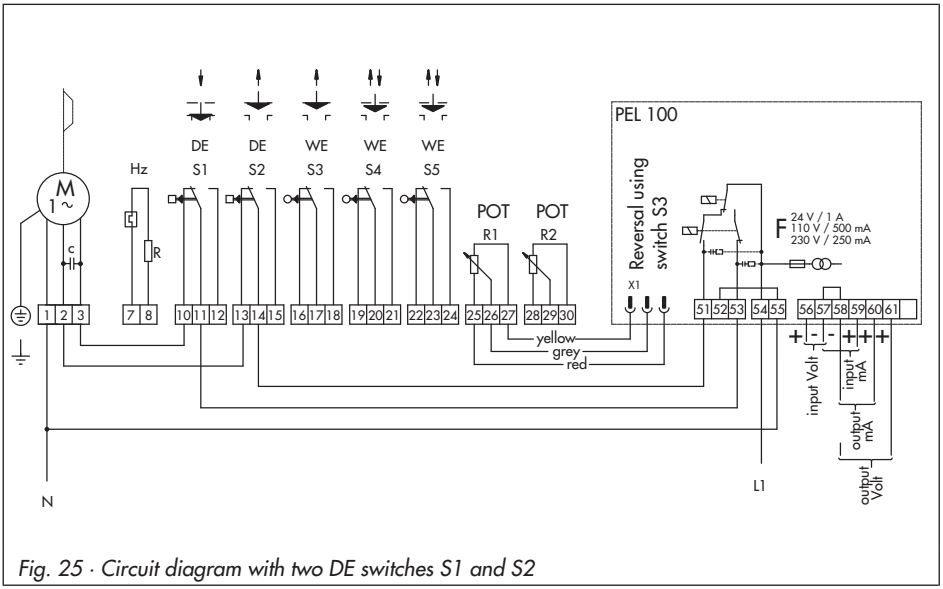


Fig. 25 · Circuit diagram with two DE switches S1 and S2

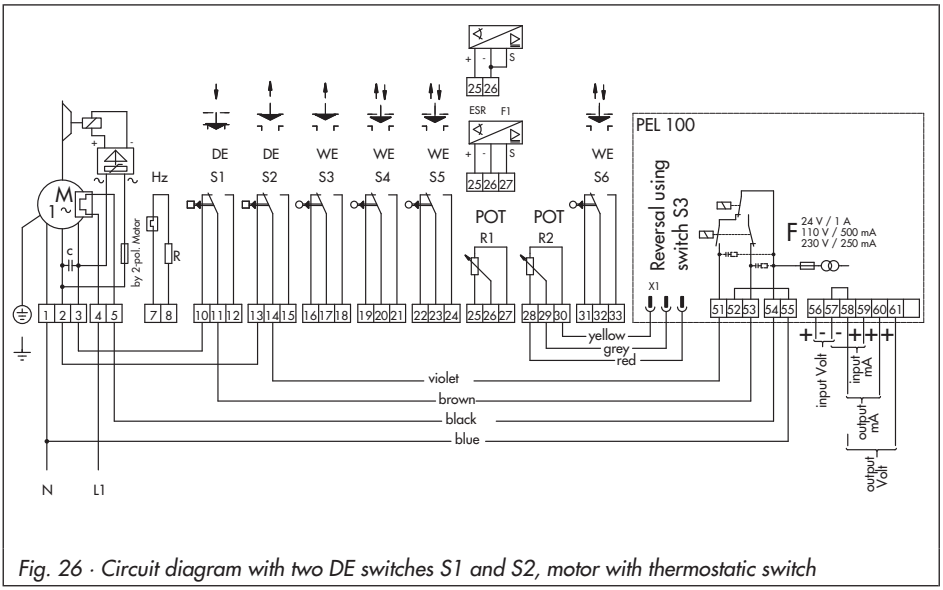


Fig. 26 · Circuit diagram with two DE switches S1 and S2, motor with thermostatic switch

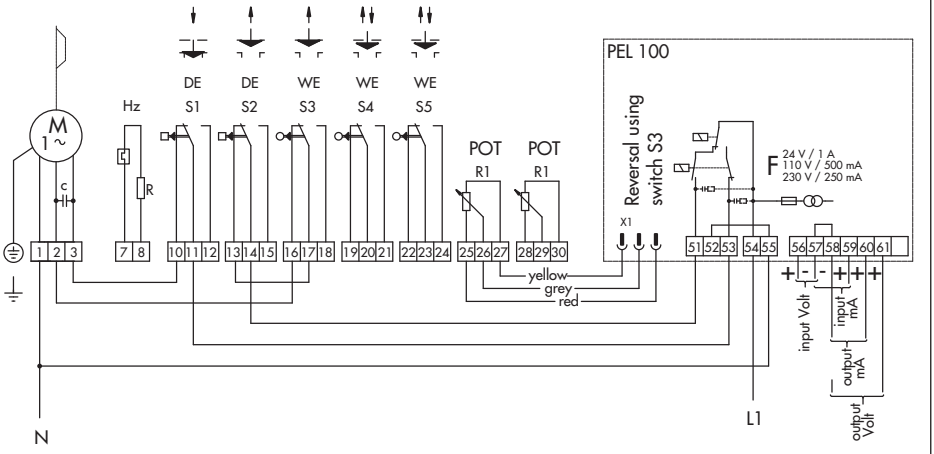


Fig. 27 · Circuit diagram with two DE switches S1 and S2 as well as one WE switch S3

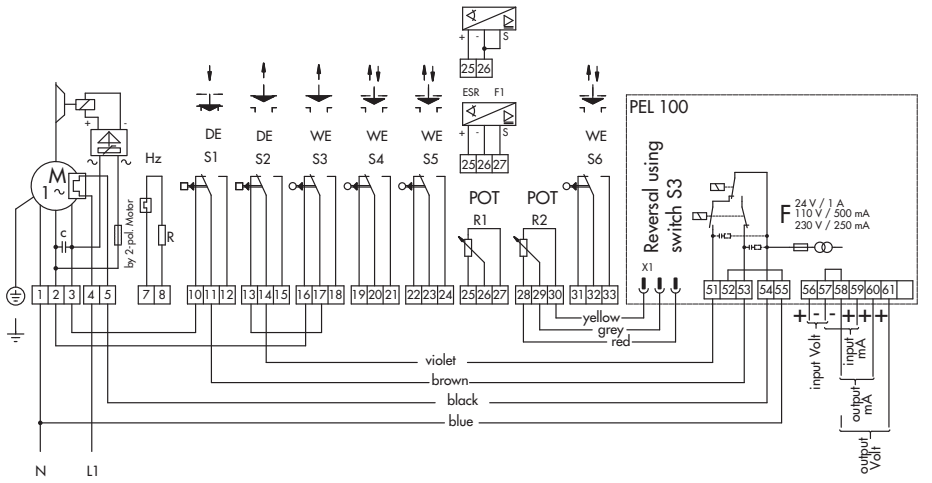


Fig. 28 · Circuit diagram with two DE switches S1 and S2 as well as one WE switch S3, motor with thermostatic switch

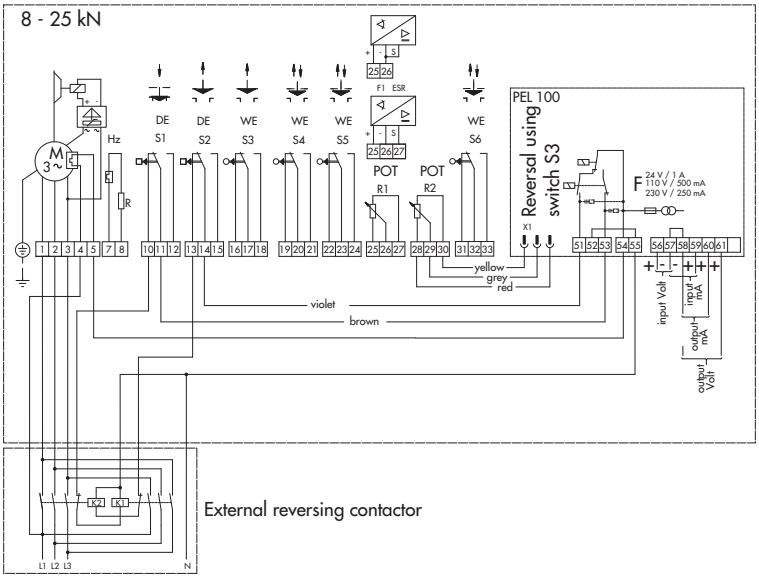


Fig. 29 · Circuit diagram with two DE switches S1 and S2 as well as one WE switch S3, motor with thermostatic switch, separate reversing contactor

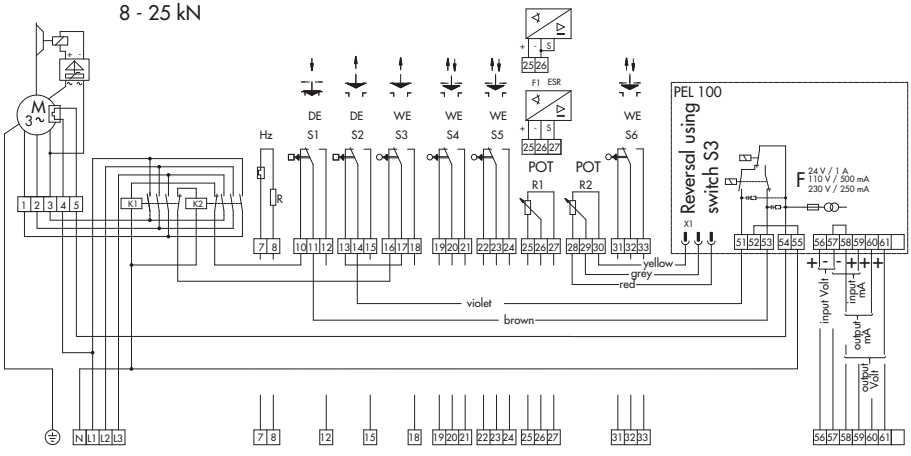
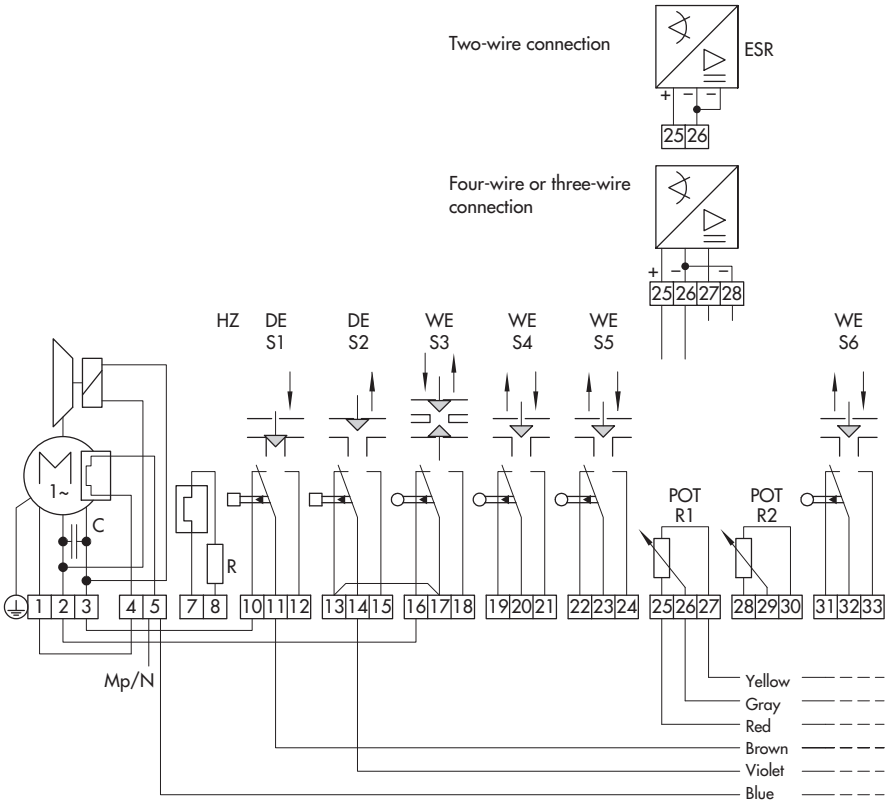


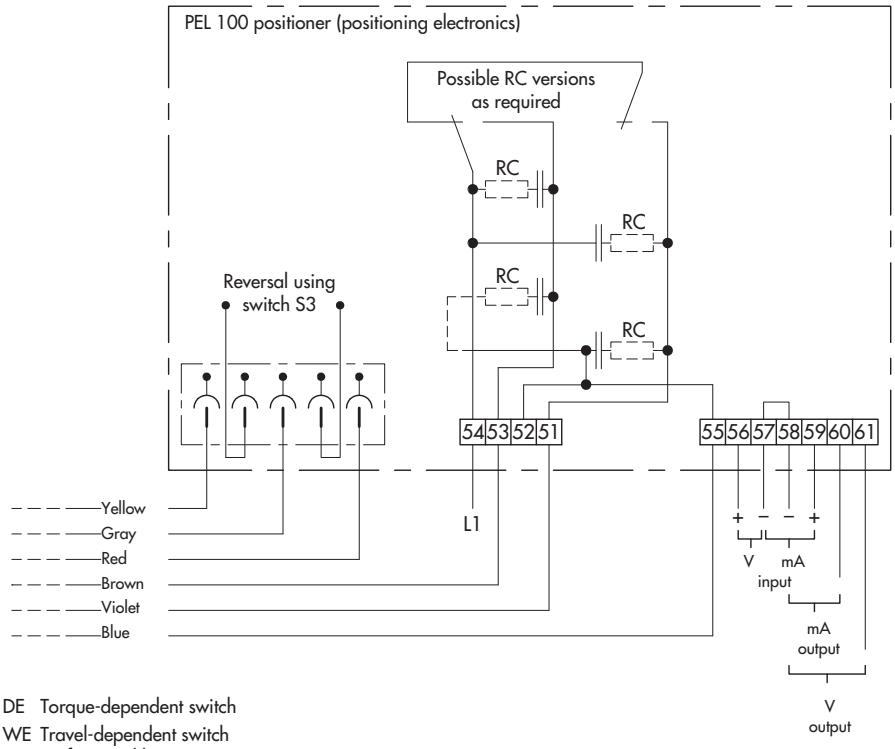
Fig. 30 · Circuit diagram with two DE switches S1 and S2 as well as WE switch S3, motor with thermostatic switch, integrated reversing contactor

13.1 Circuit diagram of Type SAM-... with positioner (maximum equipping options)



– Circuit diagram shows maximum equipping options
– Input 0(4) to 20 mA or 0(2) to 10 V predetermined by SAMSON depending on the order specifications
– 230 V supply voltage at terminals 54 (L) and 55 (N)
– Electronic position transmitter ESR

Fig. 31 · Circuit diagram, Types SAM-01 to -52 Actuators with positioner



DE Torque-dependent switch

WE Travel-dependent switch
S3 for travel limitation
S4 to S6 to indicate intermediate positions

POT Potentiometer

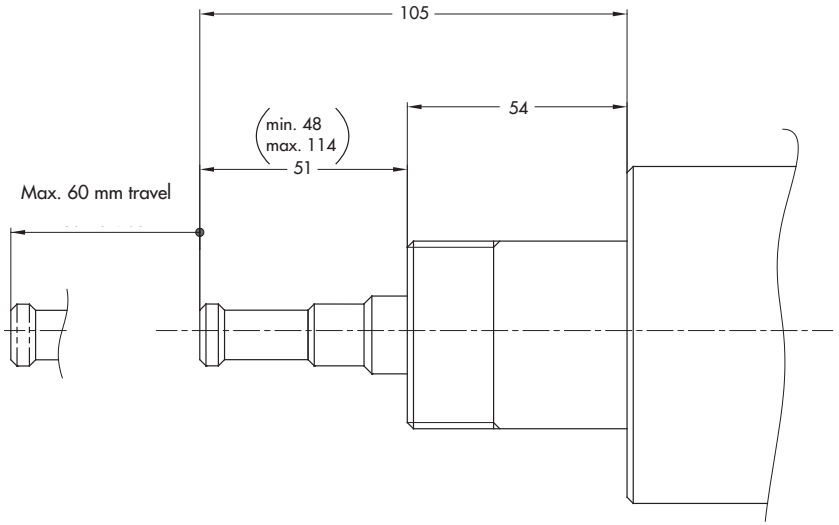
HZ Heating resistor

ESR Electronic position transmitter

14 Appendix

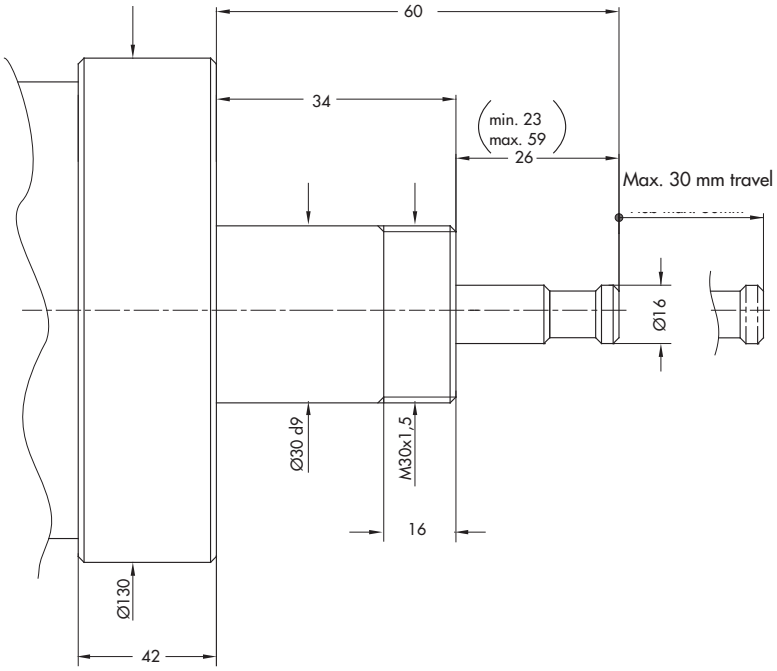
CAUTION!
To avoid damaging the internal anti-rotation fixture, make absolutely sure that the actuator stem is not extended or retracted more than specified in the max. and min. specifications.

60 mm travel



All dimensions in mm

30 mm travel



All dimensions in mm

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